DOCUMENT RESUME

ED 267 406 CS 209 577

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TITLE Computers and Writing: Casting a Broader Net with Theory and Research. Working Draft.
PUB DATE 30 Jan 86
NOTE 33p.
PUB TYPE Viewpoints (120)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Educational History; *Educational Technology; *Educational Theories; Interdisciplinary Approach; *Microcomputers; *Research Needs; Technological Advancement; *Theory Practice Relationship; Word Processing; Writing Instruction; *Writing Processes

ABSTRACT

Four overlapping areas of exploration have sparked creative thought about computers and their relationship to writing. The area receiving the most attention is computers and writing pedagogy. Some of the directions taken by research in this area have focused on computers and the composing process; computers, writing instruction, and learning style; computers and exchanging information about writing; computers and responses to student writing; and writing aids. The second area of exploration takes into consideration the theoretical implications of computers and revolves around the following theoretical perspectives: communication, language, and rhetoric and writing processes. The third area of exploration considers computers from a historical perspective--the history of the machines and how they have been used in communication, information exchange, and education. The final area of exploration considers computers from a knowledge base outside the discipline, including computer science, psychology, brain research, and ethics. As computers continue to be added to the writing environment, it becomes all the more important to integrate what has already been discovered about the composing process with these four areas of investigation. (HOD)

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Computers and Writing: Casting a Broader Net with Theory and Research

Working Draft: 30 Jan., 1986
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CS209577

> [There is] a sort of secret and tacit compact among the learned, not to pass beyond a certain limit in speculative science. The privilege of free...thought has at no time been held valid in actual practice, except within this limit; and not a single stride beyond it has ever been ventured without bringing obloquy to the transgressor.
>
> Coleridge, Biographia Literaria, 95-96.

In 1978, Richard Young used this quotation from Coleridge to explain how paradigms can result in a narrowing of vision (p. 30). He agreed with Kenneth Burke (1954) that paradigms are "a way of seeing" and of "not seeing," that such structures can limit the nature and the direction of research and theory in a field. Young discussed the limitations of paradigms to call attention to the creative investigations being done, at that time, by process-based researchers. He asked professionals in the field of English composition to view their discipline from this new vantage point, and he acknowledged the risks inherent in such exploration.

Today, our profession is faced with a similar problem--the problem of developing new vantage points from which to consider the use of computers in writing programs, writing classrooms, and individual writing processes.

In most cases, we have been content to "see" and "understand" computers in terms of machines we already know. We observe

that they can function like highly sophisticated typewriters, and so we incorporate them into our classrooms as word-processors with minimal changes to the curriculum. We understand that they can function as intelligent teaching machines, and so we incorporate them into our writing labs as electronic tutors, again with minimal restructuring of the teaching and learning environment.

However, these outdated machine metaphors might not be the most accurate or useful terms we can use in understanding the relationship between computers and writing. In fact, none of the evidence collected thus far supports the perception that computers act merely as "intelligent" typewriters or "super" teaching machines. Even preliminary research suggests that computers have had a much more profound impact on writing, language, and thinking--that they have altered the very nature, the content, and the form of human communication (Hiltz and Turoff, 1978; Kling, 1980; Kiesler, et al., 1984).

In this sense, our profession may be guilty of subscribing to a limited view of computers and their effects on writing--a view circumscribed by past experience. We have brought to the computer revolution a traditional vision of writing that is defined by theories and research on paper-and-pencil composing, and this vision may not be capable of accommodating the changes wrought by the electronic medium we

are now using. By subscribing to this vision, our profession has, as Coleridge says, created a "tacit compact" not to pass beyond a certain limit in speculating about computers. Now may be the time to take risks in our thinking, to broaden our vision.

One way to expand our vision of computers as they relate to writing programs is to define a broader range of basic questions for future research and theoretical projects--a range that will invite divergent perspectives on the nature of computer-assisted writing activities. This paper is our attempt at this task. On the following pages, we suggest four overlapping areas of exploration to spark creative re-formations of our thinking about computers and their relationship to writing.

I. Pedagogical Departures: Computers and Teaching Writing

Of the areas we discuss in this article, computers and writing pedagogy has received the most attention. Teachers and researchers who use computers as writing aids are beginning to make systematic observations of how they are affecting writing processes, both positively and negatively, in their own classrooms and computer labs (Bickel, 1985; Day, 1985; Haselkorn and Connors, 1985; Sommers, 1985; Womble,

1985; among others). Unfortunately, these pedagogical projects remain isolated ventures; findings, based as they are on different machines, software, configurations, assignments, vocabulary, rhetorical assumptions and theories, provide us with only a dim vision of a much larger whole. We are, in effect, laboring to solve a complicated puzzle, having only a few unconnected pieces with which to work. There is constant change with respect to hardware and software; the questions we need answered are those that transcend hardware and software dependency. Fortunately, a few researchers are beginning to develop comprehensive theoretical and pedagogical approaches to the role of computers in the writing process. [1]

To obtain a more accurate picture of the impact computers can have on the teaching of writing, to construct even a vague outline of the larger puzzle, we must continue our pedagogical studies. It is only when enough of these studies have been done, that we can begin to compare results of research projects, share and standardize effective or useful

vocabulary and research designs, replicate and reconsider previous investigations.

The list that follows identifies a few of the directions we think such research might take.

Computers and composing processes

Although preliminary observations of writers who use computers as part of their composing process (Bridwell 1984; Selfe, 1985) suggest that computers may affect composing activities, rhythms, and patterns, most experts agree that is still too early to draw generalizable conclusions (Bridwell and Duin, 1985).

To find out how, or if, the use of computerized word processors affects invention, recursiveness, planning, goal setting, arrangement, task constraints, reading and rescanning, drafting, revising, editing, or proofreading, we need to cast a wider net with our research efforts.

We must observe writers in both naturalistic and laboratory settings; compare experienced and neophyte computer users; follow the composing patterns of writers over a long period of time as they learn to use computers; determine whether computers are used differently for writing tasks that involve different aims, audiences, or organizational structures. We need to see whether word-processing applications affect writing processes, whether particular kinds of software have an impact on how people use the computers to compose. And we need to know how, or if, computers

affect writing when they are used only at specific points during the composing process--for first drafts, late drafts, or final products.

Such research could give us a clearer sense of how computers are best integrated into students' composing processes. We might find, for example, that computers are not equally compatible with every student's composing patterns or that computers may be more useful for some types of writing than for others (Ross, 1985; Selfe and Wahlstrom, 1985). We may also find that computers have different benefits when they are employed at different points of the composing process. Information on these matters will directly affect the way in which teachers choose to use computers in writing instruction.

Computers, writing instruction, and learning style

Just as we need a clearer and more accurate picture of how computers fit into individuals' composing processes, we need more information on how these machines fit individuals' learning styles and cognitive styles. Recent studies of computer-assisted instruction, for example, indicate that the value of computers as learning aids may be determined by such factors as the age of the users (Kulik, et al., 1980, 1983, 1984), their gender (Kiesler, 1983), or their particular educational needs (Fisher,

1983). Do such factors affect students' use of computers as word processors as well? Further, do students' preferences for auditory (Lees, 1985) visual or tactile learning; or their attitude toward computer learning affect the way in which they use computers as writing aids?

Computers and exchanging information about writing

For our students, writing has traditionally been a solitary dorm-room activity. However, preliminary research on the use of computers as writing tools indicates that they can have a direct influence on this pattern (Bernhardt and Appleby, 1985; Herrmann, 1985). A study by Selfe and Wahlstrom (1985), for example, implies that locating computers in college writing labs can increase the frequency of students' collaborative writing efforts and influence the content, form, and structure of collaborative exchanges. Future studies in this area can answer questions that have only been suggested by these preliminary investigations:

> Does the physical organization of computers (whether they are netted or un-netted, placed in rows or circles, located in private offices or public spaces) affect students' willingness to collaborate on writing tasks? The form that this

collaboration takes? The content of exchanges that take place during collaborative efforts?

Do students who use computers as writing aids create a new etiquette of collaboration? Do they, for example, generate or adhere to newly created rules about reading and responding to screen drafts that differ from the traditional rules attached to reading paper-and-pencil drafts?

Are the collaborative efforts that occur on and around computers as valuable for writers as those that occur in more traditional settings, for example, in peer-critique groups? What sorts of information are exchanged when students collaborate on writing efforts that involve computers? Do they exchange more information about hardware and software than about the content or organization of their text? What effect do such collaborative exchanges have on students' composing processes?

What is the role of hard copy in the writing process? Does the exchange of on-line copy affect collaboration differently than does the exchange of hard copy? At what stages (if any) does hard copy become essential to writers? What

characterizes the interaction of writers who use both hard copy and on-screen copy?

Computers and responses to student writing

Although it is clear to us that the use of computers as writing or storage devices is increasing in our composition classes (Schwartz, 1982; Wresch, 1984; Collins and Sommers, 1985), it is not clear exactly how these machines will affect teachers' responses to student writing. We have preliminary evidence suggesting that teachers evaluate papers composed on computers and typed on printers differently than they do to papers typed on conventional typewriters (McAllister, 1985). Do teachers also respond differently to papers they read on a computer screen than they do to papers read in hard-copy form? Or do teachers' responses take on different form or content when they are conveyed via computer rather than by paper?

Using a related set of questions, investigators might also explore whether student writers or readers respond differently to teachers' or peers' comments communicated on the computer than they do to the same comments communicated in oral conferences or in comments written in the margins of their papers. Such investigations might help us determine whether feedback delivered via computer

is more or less effective in producing desired changes in writing behavior or attitude. Researchers might also explore whether student peer-critiques change in form or content when they are done on the computer, a question that has immediate implications for "paperless" classrooms.

Further work also needs to be done in exploring the potential and the limitations of using computers to provide feedback on style, grammar, usage, and language in student compositions. Some feedback systems, such as those in which teachers' comments are revealed only when students request them, have been described (Anandam,. 1979; Marling, 1983, Jobst, 1984). Reviews are mixed because as Ross (1985) suggests, we do not know yet whether the information that feedback systems might provide teachers (information about error frequency, for instance) would lead to any improvements in the teaching of writing.

Writing Aids

The explosion of programs designed as writing aids (word-processing software, spelling and grammar checkers, thesauruses, style analyzers, invention and revision aids) has left many teachers bewildered The problem is intensified by the lack of information--observational, pedagogical, and theoretical--about individual programs.

If we hope to use computer-aided writing in a pedagogically sound manner, for example, we need to identify the educational objectives of individual utility packages to determine how these packages fit into the writing instruction happening in our classrooms or our writing centers. We also need to identify the range of ages for which individual utilities are most valuable; how writing utilities are best selected, evaluated, or field tested; and whether systematic standards for selection, field-testing, and evaluating are feasible.

Teachers, for example, must learn more about the theory that informs individual writing-aid packages. Are packages process- or product-oriented? Are there options for students to plan an writing project and also revise or polish it? Is the program rhetorically specific, designed to help students with the writing of a narrative or a descriptive paper? Or is the program generic, based on the theory that all papers can be approached in essentially the same way? Knowledge of a package's theoretical underpinnings is essential because theory will determine the content, structure, and potential uses of a utility. Such data will also help teachers ascertain the program's value to students within particular writing classes.

Observational studies are needed to determine how individual writing utilities affect students' writing processes, written products, or attitudes toward writing. Do, for instance, certain writing utilities affect students' composing patterns? Do they affect teachers' evaluation of papers as Kiefer and Smith (1984) suggest? Will certain packages improve student grades? Although some observational investigations have been done on programs such as SEEN (Schwartz, 1984), Catch (Dauite, 1984), Writers' Workbench (Kiefer and Smith, 1984), and Burns' invention programs (1979), most utilities remain entirely unexamined. Investigations of utilities should take a "multiple offense approach" (Young and Fulwiler, 1985) involving a variety of methodological approaches--large and small samples, long- and short-term studies, random and special populations, laboratory and naturalistic contexts--to insure that results are as informative and reliable as possible for teachers.

II. Theoretical Departures: Computers and Conception

Consistently, critics of the computer boom in composition classrooms have claimed that the movement lacks theoretical vision and direction (Collins and Sommers, 1985; Collier,

1985; Wresch, 1985). Their claims may be justified. In the headlong rush to find money for computer labs, introduce students to word processing, take writing off paper and put it on-line, few composition teachers have paused long enough to examine computers in light of their theoretical implications.

It has become increasingly clear, however, that any substantial progress in understanding computers and their relationship to writing will require a grasp of theory as well as practice. In the following sections, we list just a few of the theoretical perspectives that can help us construct such an understanding:

Communication theory

All too often we fail to look at composing processes and computer-aided writing in the larger context of human communication systems. Current work in communication theory explores how information technologies are altering the social, psychological, and organizational dimensions of human interaction (Hiltz and Turoff, 1978; Kling, 1980; Kiesler, et al., 1984). We can look to investigations in this area for answers to questions like the following:

How do various computer systems (netted or un-netted, mainframe or micro) affect written products and the exchange of information about writing among users?

How does the use of computers affect ownership of text and ideas?

How do computers influence the etiquette of communicating about writing (what writers say to each other about their composing efforts, when and how they exchange information about writing tasks).

How does computer-assisted writing fit into existing models of communication or speech acts? Can these models enhance our understanding of what goes on when students use computers to write?

Language theory

As linguists and computer experts come closer together in their studies of natural language simulation and artificial intelligence, tantalizing connections between language and computers emerge. Already, efforts have been made to use the computer for morphological and semantic analyses (Simmons, 1977; Allen, 1982; Schank, 1982) and numerous efforts are underway to program computers for

natural language input (Ross, 1985). Such work suggests the value of further studies which are grounded in linguistic or language theory, related to the teaching of writing, and germane to concerns like those listed below:

> When authors use computers to produce text, is their writing different in some linguistic sense? In the number, types, or frequency of words? In the syntactic structure of phrases, clauses, or sentences? If so, why? What bearing would this phenomenon have on existing theories of lexical density, semantic integration, coherence and cohesion?

> Does the language used in computer-assisted instruction packages or writing utilities affect learning? Do, for example, user-friendly directions improve or hinder learning? Retention? Are user-friendly directions the most effective means of conveying information? Are other "voices" for CAI (neutral, admonitory, passive, for example) more effective in certain writing utilities?

> Does the use of computers as writing or reading aids affect language acquisition? Language development? Literacy? How can we best use computers to help us

study these questions involving language? Currently, we have programs that count words, create concordances, repair text, analyze text, record key strokes of individuals as they compose at the computer, translate foreign languages, tags words according to their class and/or function, spot potential grammar and usage problems, and process syntax in a limited sense (Ross, 1985). Which of these programs are most useful to writing teachers, students, and researchers? What kinds of programs do we need to develop if we want to continue and to expand our research on language, especially as it relates to computerized text generation?

Rhetorical theory and writing-process theory

Recent work in rhetorical theory and writing-process theory has direct implications for computer-aided composition. Corder's (1985) recent survey of the "many fine rhetorics" and his distinction between "modern" (that is, revisions of traditional) rhetorics (p. 163) and "new" (that is, not yet invented) rhetorics indicates the richness and complexity of study open to us. Unfortunately, although some teachers have relied heavily on modern rhetorical theory to shape, in an indirect sense, the writing programs and utilities they create for use on computers (Burns, 1984; Von Blum and Cohen, 1984;

Selfe and Wahlstrom, 1985), few efforts have been made to identify, more directly, how rhetorical theories touch on (or are touched by) computers. Explorations of a theoretical sort can help inform our use of computers in writing programs by addressing questions like the following:

> Does the use of computers as writing aids affect models of rhetorical theory as we have currently constructed them? Does, for example, an electronic mail system alter our theoretical notion of audience? Does electronic word processing affect our concept of invention? Development? Organization? Arrangement? Style?
>
> Does the writing produced on the computer have different textual features than writing produced in a more traditional manner? Does computer-generated text affect our current theories of cohesion? Coherence? Reference? Discourse analysis?
>
> Does computer-aided writing affect our theories of composing process? Does the use of the computer as a writing tool have a bearing on the models of local and global planning we currently see as valid? Does the use of the computer

affect our theories of task constraint? Writer- and reader-based prose? Goal setting?

III. Historical Departures: Learning from the Past

Because computers are so obviously tied to current and future technology, the benefits of looking at these machines from historical perspectives may not be immediately obvious. And yet, if we hope to establish a clear sense of the role computers can play in our writing programs and classes, we must understand some basic things about the history of these machines and how they have been used in communication, information exchange, and education.

Historical investigations may provide us with particularly valuable perspectives when they place computers in the larger framework of communication technology, especially because computers have a relatively short "history" of their own. Will computers, for example, affect us as much as did the printing press? As much as did the telephone? Radio and television? Without such historical context, we can only understand computers as phenomena isolated in time--at best a limited vision. Following are just a few of the historically-based questions that, when addressed, could help inform our current use of computers:

Are there lessons we can learn about computers from

studying the history of other technological innovations, in education and in writing instruction: television or self-paced, electronic machine learning as used in the 60's? Are there lessons we can learn about computers by studying the history of other communications technologies: The printing press? The telephone? Photocopying equipment?

To date, how has the use of computers as writing and learning aids influenced pedagogical approaches in the teaching of writing? Philosophical approaches to the teaching of writing?

As a profession, can we learn something by looking at the historical development of computers? Can we use such knowledge to predict how computers and their role in writing instruction will change? To provide more direction for engineers who manufacture the machines or the software that we use in our writing classrooms?

If we look at other disciplines in which computers have been used successfully (or unsuccessfully), can we learn some lessons that will benefit our own area of study? Will studies of computer use in math education, for example, help us define those criteria that make for the most effective use of computers in writing programs or classrooms?

III. Interdisciplinary Departures: Making Connections

Attempts to understand complex phenomena in our own area of study are sometimes best launched from a knowledge base outside the discipline. Thus, the work of Flower and Hayes (1979), based as it is on the use of protocol-analysis techniques used in cognitive psychology, has provided us with important insights about the wring process. In a like manner, our understanding of computers and their role in writing programs may be enhanced by a look at areas such as those we have listed below:

Computer Science

Because many of us lack the technical background necessary to understand the more sophisticated concepts in computer architecture and software engineering, we have not always profited by studies computer scientists complete. We have, for example, just begun to use the computer to store descriptions of what happens as individuals compose (Bridwell, 1985; Haselkorn and Conners, 1985) and to give feedback on written essays (Anandan, 1979; Marling, 1983; Jobst 1985) or prose samples (MacDonald, et al., 1982). We have done very little, however, to apply directly the recent work on screen design or artificial intelligence to computer-assisted

instruction in our writing classes. Nor have we taken advantage of new techniques in computer modeling to represent or simulate, even at rudimentary levels, the intricate goal-setting or decision-making activities involved in the writing process.

Related research on ergonomics and the physical layout of computer labs can also inform our use of computers in writing centers and classrooms. Ergonomic studies can help us decide, among other things, whether we must change the lighting in our writing centers when we add computers, how to arrange computers to minimize keyboard and printer noise for writers, how to tilt computer screens and copy stands to help our students avoid eye strain, and what kinds of chairs might help reduce muscular-skeletal fatigue for writers during long drafting sessions.

Psychology

Writing researchers already use techniques of protocol analysis, borrowed from psychology, to provide data on how computers affect the composing and reading processes of individuals. psychology-based studies can also help us investigate how, or if, computers affect short- and long-term memory as it is used in the writing process, writing apprehension, and reading apprehension. Such studies might explore, for example, how, or why, some writers are afraid to

use computers or what psychological constrains are involved when authors use computers as writing tools.

Using approaches developed in psychology, we can also study and chart the eye movements of authors as they write and read their text on computers. This data should help us understand how individuals integrate writing and reading activities when they compose on computers. We can then compare the reading/writing patterns of computer users to those of pencil-and-paper composers to see if any differences are evident.

Brain research

We are just beginning to investigate the essential connections between the human brain and composing processes. The work of Emig (1978), Gazzaniga (1970, 1975, 1978), Glassner (1981), and Wahlstrom (1985) has begun to describe the complex brain functions involved in producing communications. These studies suggest that different hemispheres may come into play at various stages of the writing process and that patterns of hemispheric activity may differ with certain kinds of writing. Brain research might help us discover whether some writing assignments (perhaps because they restrict aim, mode, or content in certain ways) might be better handled on the computers than others; whether certain fonts and colors are more readable or more effective than others; and how gender,

hemispheric asymmetry, and writing fit together.

Ethics

Recent research (Selfe and Wahlstrom, 1985) indicates that writers who use computers in more public settings like college writing laboratories may exhibit different patterns of collaborating on papers, sharing text, and exchanging information about writing projects than do writers who work in more traditional, isolated settings. These findings suggest related ethical questions that would profit from attention:

> How does the use of computers as writing tools affect the ethics of authorship? Collaboration?
>
> Does the anonymity afforded by an electronic critiquing or feedback system encourage students to make more liberated responses to peers' papers? Be less responsible in their responses?
>
> Do computers, with their amazing capacity as storage and data retrieval devices, encourage or reduce plagiarism in writing classes?
>
> When is material composed on a compute "shareable"? At

what point should teachers and other students have access to it? Is it fair to ask students to compose on "public" screen? in a computerized, writing-intensive classroom, should teachers be able to access all drafts of students' papers? All of their responses to computer-assisted writing instruction? When do such practices violate students' rights to privacy?

How should teachers approach issues involving computer ethics? Should they encourage students to protect their files with passwords? Encourage a communal space for disk storage? Keep confidential records, evaluations, tests on computers?

How should teachers address issues like visual eavesdropping (looking at text on a computer screen without the permission or knowledge of the author)? On-line or group authorship?

Finally, what are the ethical questions involved in working with a computer as a co-author? As we make increasingly bold strides in artificial intelligence, will students need to cite computers for assistance with spelling, grammar, style, or invention?

Conclusion

In his essay on paradigms, Richard Young noted that our growth as a profession has been limited at times because we lack a clear picture of our own history as a discipline, that we are, in some important ways, cut off from our past.

We would add that composition specialists are too often cut off from contemporary avenues of understanding as well-divided from colleagues who teach literature, because of departmental politics; isolated from linguists and communication theorists, for historical reasons; and separated from faculty in other disciplines who see us as providing a service to the academic community rather than pursuing scholarship in our own field.

As we continue to add computers to our writing environments, we have an opportunity to overcome our isolation, to integrate what we have already discovered about composing processes with a variety of intellectual concerns, to see computer-aided writing from new theoretical and research vantage points, to make exciting new connections with other scholars.

Indeed, if technology continues to develop as rapidly as it has in the past decade, we may have no choice in the matter. Our increasing use of computers as composing tools may force us to debate, investigate, explore, and revise our ideas about, our information on, and even our definition of writing. the amount

of research that needs to be done is staggering, but the fact that there is so much to do is also liberating. We are at the forefront of something significant, and virtually any research we perform, or any creative thinking we do, will yield valuable clues about how computer technology touches the most human of human activities--writing.

ENDNOTES

1. Exciting new pedagogical and research projects are now underway. Among them, the work of Helen Schwartz on teaching with computers at Oakland University (1985), the WARRANT project at Carnegie-Mellon, and the work on error detection and computer-assisted teaching going on at the University of Pittsburg.

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